mental temperature data are the daily values, and when these are considered in their relation to the seasonal normal, they furnish an even more striking and interesting picture of our migrations between warmer and colder latitudes. Some one has described the average, or normal, meteorological condition as "that which never occurs"; certainly it seldom occurs.

Unlike the poet, the meteorologist has no special license to indulge in figurative speech, but with the indulgence of the reader, we shall at this point digress somewhat from the orthodox phraseology usually employed in scientific explanations of natural phenomena, and give a brief paraphrased description of our daily climatic travels during a short midwinter period of the present year.

Let us draw a mental picture of all Washington, D. C., as being aboard a weather train that transports us alternately between northern and southern latitudes as the temperature from day to day varies from warmer to colder or vice versa. The major travels for this train during the winter just closed may be seen most graphically in figure 2, where the important peaks and crests of the mean daily temperature curve are marked with the names of the places where such temperatures are normal for the season. To emphasize the erratic nature and extent of these travels, a 10-day period in midwinter of the current year will be followed in detail; the train will be considered "at home" when the temperature for the day at Washington is normal for the season. Starting from home on January 17, 1921, our train headed for the North and did not stop until Eastport, Me., was reached on the 18th. The following day a short reconnoitering trip farther up the coast in New Brunswick was made. We then turned southward, reaching Washington on the 20th. Only a one-day stopover was made at home, however, and our journey was resumed toward the South.

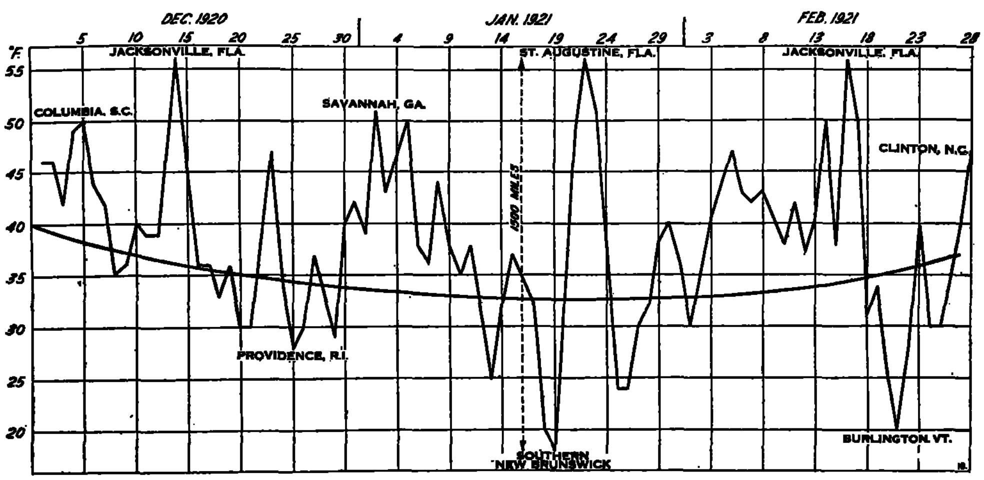

FIG. 2.—Mean daily temperatures at Washington, D. C., Dec. 1, 1920, to Feb. 28, 1921.

The 21st was spent at Wilmington, N. C., while St. Augustine, Fla., was scheduled for the following day. Remaining in this well-known winter resort only one day, the return northward was begun; Savannah, Ga., was passed on the 23d and Richmond, Va., on the 24th. At this point more steam was applied and the following day we appeared in southwestern Maine. After remaining there two days, another southward journey was begun, passing through Washington on the 28th.

Fort Pierce, Fla., about 75 miles north of Palm Beach, is the farthest south Washingtonians have ever spent a day climatically in January. An outing has been enjoyed at this point twice in the last 50 years, on January 12 and 13, 1890, and on January 27, 1916.

It is obvious that the conductor of this figurative weather train has anything but a fixed schedule, and apparently without rhyme or reason, changes his plans on the spur of the moment and acts accordingly, absolutely refusing to take the public into his confidence. Now, here is where the official forecaster of the Weather Bureau comes to our assistance. Each and every community in the United States is the headquarters for a weather train that is constantly moving climatically north or south. The schedules are controlled by physical laws, and the forecaster must determine each day in the year just what the schedules for the following day or two are to be for each train operating under this vast transportation system. This determined, he announces them for the benefit of the public that they may make their plans accordingly.

The question, however, is not even so simple as here indicated, for at one time Dame Nature may decide on considerable uniformity of movement and order all trains over a large section of the country in the same general direction, either north or south; while at other times, no such uniformity exists and even in near-by localities the train movements may be oppositely directed. In the first case, the whole system may be viewed as being operated under orders issued from a central office by a general train dispatcher, with a definite plan of coordinated movements, while in the second case the matter is apparently left to the whims and wishes of the conductor of each individual train. A large percentage of the forecaster's failures of verification occur under the latter conditions. Viewed in this light, his job is by no means an enviable one, and we must agree that a verification record averaging 85 to 90 per cent perfect, the record he is making to-day, is creditable.

One week ahead is now about the limit of a reliable schedule. Imagine, if you can, what a schedule weeks in advance would mean to us stationary weather travelers.

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OPEN WINTER AND PLANT LIFE.

[Reprinted from the *Philadelphia Public Ledger*, Jan. 5, 1921.]

An open winter, such as is being experienced in this locality this year, is generally more injurious to plant life than it is beneficial, in the opinion of Dr. John W. Harshberger, professor of botany at the University of Pennsylvania.

Certain plants, according to Dr. Harshberger, have been so protected and planned by nature that they are unaffected by such unusual weather, and in other cases no definite harm is done unless the warm period lasts a long time.

Warm weather in winter is not especially injurious to plant life unless it starts dormant buds to swell and burst open, thus exposing the delicate leaf and flower tissues to the action of the succeeding cold spell.

There are many native plants, trees, and shrubs which are not ordinarily stimulated to development by warmth in the winter season because they have been long adjusted to the particular climatic conditions of eastern North America. Meteorologists tell us that this exceptional weather has had a counterpart in the past, and as our native plants have existed for many thousands of years, there is no doubt but that they have many times been exposed to conditions to be found to-day.

Then there are many plants which normally blossom early in the year before actual spring conditions come. In this category are the skunk cabbage, the witch hazel, and the like. These plants are not especially injured by periods of cold weather succeeding an open winter.

In addition, there are a few plants introduced from Europe and other countries, such as the Japanese witch hazel, the snowdrop, the winter aconite, and the Christmas hellebore and others, which frequently flower in January succeeding a few days of open, warm weather. When this warm spell is in turn followed by snow, the winter aconite and the rest of these garden species are completely covered up, and when that snow melts they are found to be uninjured.

Snow is good protection to plants.—In fact, snow is one of the best protections that plant life has against the rigors of winter. A cold, snowless winter, with high winds and low temperature, is much more destructive, generally speaking, to plant life than a winter with a heavy snowfall. This ability of the snow to act as a blanket for plants has been repeatedly shown in the north of Italy, where an early spring snowfall will do less damage to crops than a late, snowless period of cold weather accompanied by high winds and bright sunlight.

During the early months of 1920 there was a very interesting exemplification of the action of a frozen soil and cold weather. The soil was frozen to the depth of more than a foot and later a heavy snowfall came, which partly melted and was again frozen to form an icy sheet several inches thick. This was followed by an extremely cold spell with strong winds and bright sunlight, which, however, was counteracted by the blanket of snow and ice.

It is a fact, however, that hardly any season in the annals of Philadelphia horticulture has been more trying and detrimental to conifers, rhododendrons, and other evergreens than was last season. Rhododendrons were destroyed by thousands where gardeners had not had the forethought to cover the roots with a heavy mulch of forest leaves and other litter. The reason for this destructive action was the fact that during the winter rhododendrons and kindred species are constantly giving off considerable amounts of moisture, and this loss of water from the surface of the plant is increased by bright sunlight and strong winds. The water thus given off during an ordinary winter is obtained from the soil, but in 1920 the soil was frozen to such a depth that the roots were unable to obtain the water necessary to replenish the loss from the surface, and consequently the plants dried up, their leaves turning brown and withering, with a result as disastrous to the tops of the plants as a fire would have been.

Many plants get rest in winter.—The period of winter is advantageous to many plants, which enter a period of rest at this time, giving an opportunity for the ripening of the wood and the maturing of the buds. This has a beneficial result on the gradual preparation of the underground parts of the plants for the burst of spring growth. In fact, some bulbs and some seeds will not begin growth until they have been subjected to either the cold of winter or the drought of such climates as we find in the great deserts.

This feature is known as the "rest period," and for this reason an open winter, in giving no such opportunity, is sometimes succeeded by a less vigorous growth the following spring, as contrasted with a winter of abundant snowfalls and normally low temperatures, which produce the necessary ripening effect on buds and other dormant parts of the plant.

A cold spell is particularly dangerous to plant life after a period of warm rains with open grounds, because most plants absorb water during the winter and become gorged in their overground parts. A subsequent freezing is liable to burst the delicate tissues of the plants. Frost cracks on trees are a good example of this danger, and they are quite likely to result, particularly if the cold spell is followed by bright sunlight. Without the latter the water which is frozen out of the plant tissues may be absorbed back again so slowly into the living cells of that plant that the destructive action is prevented; but with bright sunlight the ice is expanded within the plant, resulting in the aforementioned rupture of plant tissues.

For this reason, in the protection of delicate plants it is more important frequently to protect them from the sunlight in winter than from the cold weather.

Plants safe if buds are closed.—The danger of frost in the spring or in any open spell of weather during the winter months is largely due to the influence which heat has in expanding buds and starting dormant parts of plant life into activity. As long as buds remain closed there is ordinarily little cause for worry from succeeding cold weather, but if the warm period is of long enough duration to cause the buds to expand the following cold weather generally destroys the delicate parts within, which are then no longer protected by the bud scales. The latter are provided by nature with cork, resin, or cottony or silky hairs to offer resistance to the action of the climate.

The most destructive action in buds is the entrance of water between the bud scales, for this expands in freezing and tears the frail parts of the plants to pieces. The presence of the resin and other of nature's aids helps prevent this state of affairs.

On the other hand, it is equally true that the presence of frost and ice is very beneficial to the soil in which many plants are found, because it tends to pulverize the larger soil particles through the expansion of the ice particles. As a consequence, soil exposed to the action of frost is mellowed and made fit for the growth of subsequent crops.

A final destructive effect of an open winter as contrasted with a normal one is the fact that many plants are stimulated unduly, thus shortening their lives, because the reserve foods are used up before the rapid demand of the plant comes for the expenditure of such stored materials.

FREEZING OF FRUIT BUDS.

By FRANK L. WEST and N. E. EDLEFSEN.

[Extracted from Journal of Agricultural Research, Jan. 15, 1921, Vol. XX, No. 8, pp. 655-662.]

[Authors' summary.]

(1) Efficient orchard heating demands an economical use of labor and fuel and requires knowledge of the temperatures that cause injury to the buds.

(2) This paper contains the results of seven years' experiments in freezing 24,000 apple, peach, cherry, and apricot buds, together with a record of the natural freezes